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THE ASSOCIATION OF A FISH WITH A HYDROID.

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Among the most interesting phases of animal existence are those examples of commensalism or "messmateism" known in many instances to exist among species of widely different phyla. At times the association, while no doubt beneficial to both parties, is purely accidental, such as that occurring occasionally between the colonies of various hydroids and crabs or molluscs and on two occasions I have found flourishing colonies of *Clava leptostyla* attached to the spines of the sea urchin, *Strongylocentrotus franciscanus*. Again what appears to be a communistic association may in reality be a case of parasitism as, for example, the relation of certain hydroids and the eggs of a number of fishes, or possibly one hydroid to another as noted by Allman in his monograph on gymnoblastic hydroids, or the attachment, mentioned by Fewkes,[1] of the hydroid, *Hydrichthys mirus*, to the fish, *Seriola zonata*. In undoubted cases the association is not only invariable, or fairly constant, but mutually beneficial and very intimate as is witnessed by the fact that the hermit crab, *Eupagurus prideauxii*, when changing its abode removes the commensal anemone, or the case mentioned by Miss Rathbun[2] of the Hawaiian Island crab, *Lybia tesselata*, that held "little sea anemones one in each claw and presented them in a boxing attitude whenever teased or approached by another crab." And, on the other hand, it is generally believed that the anemones enjoy a larger food supply consequent upon the improved method of locomotion.

In 1892 Alcock[3] added what he considered to be another of

[1] *Proc. Boston Nat. Hist. Soc.*, Vol. XXIII.

[2] U. S. F. C. Bulletin, 1903, p. 866.

[3] *Ann. Mag. Nat. Hist.*, 6 ser., Vol. 10.

these remarkable mutual benefit societies, describing the association of the hydroid *Stylactis minoi* with the rock perch, *Minous inermis*. Several specimens were taken at depths varying from forty to seventy fathoms in the Bay of Bengal and the Laccadive or Malabar sea; and in every case the hydroid was found attached in large numbers about the gill opening, on the throat and in the axilla. And not only were no fish of this species ever discovered without being coated with the hydroid, but none of these hydroids was ever found upon the multitudes of other animals dredged in the same locality, though among these were specimens of *Minous coccineus*. Accordingly it thus appears to Alcock that, unusual though it is, this is a case of true commensalism.

Several years later Doflein collected three more specimens of *M. inermis* in Sagami Bay, Japan, and again all were coated, especially between the pectoral and ventral fins, with this same hydroid. In the first account the cœlenterate was assigned by Alcock, on characters associated with the reproductive sacs, to the genus *Podocoryne;* but other specimens, seemingly more highly developed, led the author later to place them in the genus *Stylactis*. On the other hand, Stechow,[1] who described the Japanese specimens, finds no evidence of sporosacs, but young medusæ with tentacles and four radial canals and accordingly this author places the species once more in the genus *Podocoryne*.

During the past summer my friend and colleague, Prof. E. C. Starks, dredged upwards of a hundred specimens of an agonoid fish, *Hypsagonus quadricornis*, in Puget Sound at a depth of approximately forty fathoms. The area over which the dredging extended was in the neighborhood of Friday Harbor and embraced an area of at least two hundred square miles where the bottom varied from sand to mud. Of the 37 specimens preserved in the Stanford University collection 10 of them are coated with a new species of hydroid, *Perigonimus pugetensis*, whose description is given later. In every specimen the cœlenterate was more abundant on the ventral surface of the body, especially in the axilla, and a luxuriant growth was usually found on the pectoral, ventral and, to a less extent, on the anal and caudal fins. With

[1] *Zool. Anz.*, Bd. 32, p. 752, 1908.

one or two exceptions the polyps were much more sparsely distributed over the body and dorsal fins. In no case were they found on the head.

Alcock, referring to several species of fishes of the family Scorpænidæ that "have the body and fins capriciously covered with long, wavy often tufted cutaneous filaments," believes, with a large company of zoologists, that these structures "assist in giving the fish a deceitful resemblance to the incrusted rocks of its environment, in order to allure, or at any rate not to scare, prey. And it appears probable that *Stylactis minoi* enables its companion *Minous inermis* in the same way to assume the same convenient and successful disguise." While the evidence is

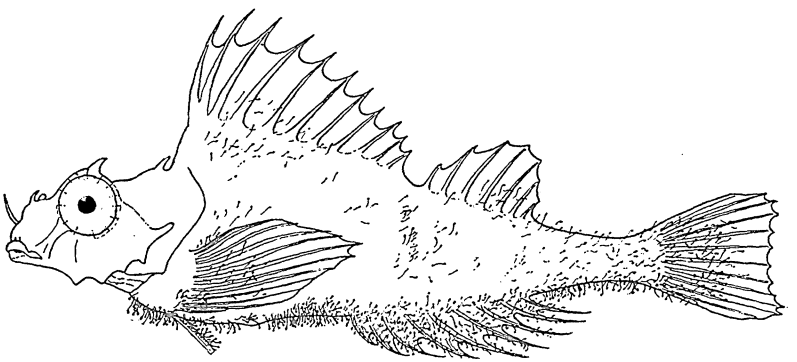

FIG. 1. An agonoid fish (*Hypsagonus quadricornis*) bearing a hydroid colony (*Perigonimus pugetensis*). Natural size.

strong that these devices do enable their possessor to escape detection and wage more successfully its battle for existence, and while the hydroid may enable the fish in question to more closely harmonize with its surroundings it does not follow even then that this is a case of commensalism. Nevertheless, as Hickson points out,[1] the fact that "the fish is never found without this hydroid, nor the hydroid without this species of fish, suggests very strongly that there is a mutual advantage in the association."

In the present case the evidence is not so cogent. About one fourth of the fishes only were overgrown with the hydroid and

[1] "Camb. Nat. Hist.," Vol. I., p. 268.

other specimens taken by the U. S. F. C. Str. "Albatross" in the open ocean off the Washington coast and in Bering Sea, are totally without them. These last named specimens, coming from the same depth (40 fm.) occurred on a pebbly bottom or one of broken shell and it is possible that the Puget Sound individuals, without the cœlenterate, occurred in a similar habitat. Be that as it may, it is a suggestive fact that in the fishes under consideration the hydroid was "attached in large numbers about the gill opening, on the throat and in the axilla," in other words over the ventral surface that is already the most concealed portion of the body. Referring to *Hypsagonus quadricornis* Prof. C. H. Gilbert writes in Jordan and Evermann's "Fishes of North and Middle America" (p. 204): "In the aquarium the fish appears to walk, resting alternately on the upper and lower pectoral rays and on the front rays of the anal." Under such circumstances the eddies produced in the bottom ooze would naturally bring the greatest amount of organic material to animals ventrally situated. The appearance strongly suggests that the advantage lies rather with the hydroid just as it does with the several species of barnacles attached to the skin of the whale. Whether the association is any more intimate in the case Alcock cites it is impossible to state conclusively, but the evidence is certainly not entirely convincing.[1]

Prof. C. C. Nutting, to whom I have submitted specimens, has kindly identified them as a species of *Perigonimus*, its nearest relative being apparently *P. vestitus* Allman. As in other members of the genus the hydrorhiza forms a highly branched, frequently anastomosing, system over the surface of the fish, but so far as noticed this contact is purely superficial, there being no evidence of parasitism. And furthermore the presence of small entomostracans and nondescript organic remains in the gastric

[1]Since this paper was sent to press I have examined upwards of two dozen specimens of this same species of rock perch (*M. inermis*) collected by my colleague Prof. J. O. Snyder, at Onomichi, on the Inland Sea, in the Province of Bingo, Japan. All of these are excellently preserved and in no instance has a hydroid been found upon them. It thus becomes more certain that the association described by Allcock is not an undoubted case of commensalism. Professor Snyder has called my attention to the fact that according to Regan (Ann. and Mag. Nat. Hist., 1905, Vol. XV., p. 20) *Minous inermis* should be *Minous monodactylus* (Bloch and Schneider).

cavity of the hydranths shows the feeding processes to be those of a non-parasitic species.

At frequent intervals branches, 3 to 4 mm. in height when fully developed, spring from this root system and each is terminated by a single hydranth. In no case does a hydranth arise as a lateral bud from the hydrocaulus, as in *P. vestitus*, for example. On the other hand, the medusa buds almost invariably appear as isolated, very rarely closely associated pairs of outgrowths dis-

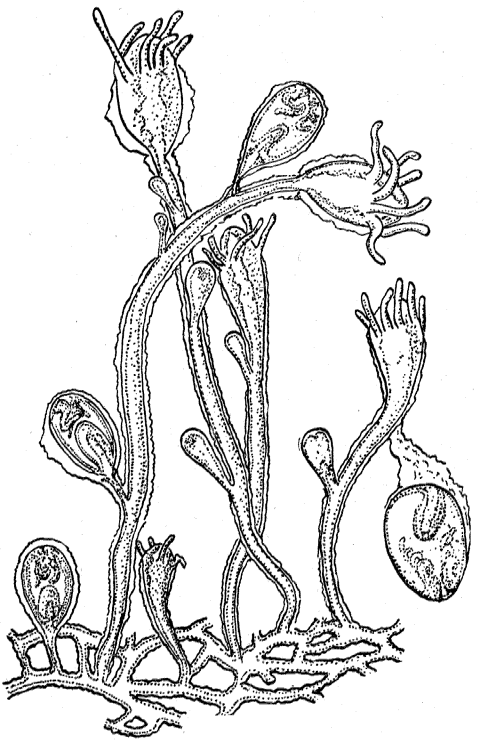

FIG. 2. Portion of hydroid colony (*P. pugetensis*).

posed at comparatively regular intervals along the stem. Their order of appearance is seemingly not so definite, though this, in part at least, is perhaps due to the escape of an unknown number of medusæ from the older stems. On the shorter, younger branches one bud appears usually in the vicinity of the base or the hydranth, and about the time its development is half way completed a second one arises in the middle section of the stem,

while a third frequently makes its appearance in the vicinity of the hydrorhiza about the time the first medusa is liberated. Beyond this point the order of development is not known, but Fig. 2 illustrates a few of several different stages. The mode of development of the medusa is typical, and results in a bi-tentaculate type.

With the exception of the distal portion of each hydranth, including the tentacles, the entire colony is ensheathed in a cuticle often coated with minute organisms and sediment. In the older portions this investment is comparatively firm with the exception of that surrounding the hydranths, which is less dense and more flexible. The medusa buds are likewise covered, and for a time prior to their detachment are bound to the stem by an irregular cuticular bridge.

In the younger hydranths the line of demarcation between them and the stem is not clearly defined, but as they become older the boundary is more distinct, the hydranth growing more globular owing, to some extent at least, to the greater height of the endoderm. In the younger stages each hydranth bears four tentacles, later four others appear, often with slight irregularities in the time intervals, and finally with the appearance of four more the number is complete.

The following diagnosis will distinguish the present species from other known forms: *Perigonimus pugetensis* new species, twelve tentacles. Hydranths arising invariably from the hydrorhiza, and bearing as many as four scattered bi-tentaculate medusæ. Cuticle relatively thin. Occurs on the agonoid fish, *Hypsagonus quadricornis*, in Puget Sound, Washington.